SMART CONTRACTS AND APPLICATIONS
(CSEN 3204)

Time Allotted : 2½ hrs **Full Marks : 60**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 4 (four) from Group B to E, taking one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A

1. Answer any twelve: **12 × 1 = 12**

Choose the correct alternative for the following

(i) Which of the following is a limitation of smart contracts?
(a) They are always secure and bug-free
(b) They cannot interact with real-world data on their own
(c) They are controlled by a single entity
(d) They require lawyers for execution.

(ii) Which blockchain feature ensures that smart contracts cannot be altered once deployed?
(a) Encryption (b) Decentralization
(c) Immutability (d) Proof-of-Stake.

(iii) What is a Smart Contract?
(a) A digital agreement stored in a centralized database
(b) A self-executing contract with terms directly written in code
(c) A physical contract stored digitally
(d) A traditional legal contract written on paper.

(iv) Which tool is commonly used to deploy and test smart contracts on Ethereum?
(a) Node.js (b) Remix (c) Java (d) SQL.

(v) Which of the following is NOT a feature of Ethereum smart contracts?
(a) They are self-executing
(b) They are immutable once deployed
(c) They can modify their own source code after deployment
(d) They are stored on the blockchain.

(vi) What is Gas in the context of smart contracts?
(a) A measure of the computational work required to execute a contract
(b) A fuel used in Ethereum mining machines
(c) A type of cryptocurrency
(d) A security mechanism to prevent hacking.

(vii) What is Solidity?
(a) Solidity is a machine-level programming language
(b) Solidity is an NFT programming language
(c) Solidity is a high-level smart contract programming language
(d) Solidity is an object-oriented programming language for web development.

(viii) Remix allows you to write
(a) Solidity contracts
(b) Solidity tests
(c) Javascript scripts
(d) All of the above

(ix) What is the key difference between a traditional web application and a DApp?
(a) Traditional web apps use a centralized database, while DApps store data on a blockchain
(b) DApps are slower than traditional web applications
(c) Traditional web apps require cryptocurrency for transactions
(d) DApps cannot run on mobile devices.

(x) What does the "Pull over Push" withdrawal pattern aim to achieve?
(a) To improve transaction speed
(b) To prevent reentrancy attacks by allowing users to withdraw funds instead of sending automatically
(c) To reduce smart contract size
(d) To increase gas fees for better security.

Fill in the blanks with the correct word

(xi) The smallest unit of Ether, often used for gas calculations, is called _____.

(xii) A DApp (Decentralized Application) runs on a _____ network instead of a centralized server.

(xiii) Ethereum transactions are identified using a unique _____, which is a 32-byte hash.

(xiv) To declare a function that only reads from the blockchain but does not modify the state, we use the _____ keyword.

(xv) A blind auction is called "blind" because the _____ of the bids is hidden until the reveal phase.

Group - B

2. (a) What is Blockchain Technology? What is Ethereum? Explain its significance in blockchain technology. *[(CO1)(Understand /LOCQ)]*
(b) What are smart contracts? How do they work in Ethereum? *[(CO2)(Remember/LOCQ)]*
(2 + 2 + 2) + (2 + 4) = 12

3. (a) What is the Ethereum Virtual Machine (EVM), and what role does it play in the Ethereum architecture? *[(CO2)(Remember/LOCQ)]*
(b) Explain the concepts of DApps and DAOs, and how they leverage Ethereum's capabilities. *[(CO2)(Understand /LOCQ)]*
(3 + 3) + (3 + 3) = 12

Group - C

4. (a) Explain the fundamental steps involved in programming a simple smart contract and describe the structure of a basic contract. *[(CO2)(Understand/IOCQ)]*

   (b) Differentiate between externally owned accounts (EOAs) and contract accounts in Ethereum, and explain the significance of gas in transaction execution. *[(CO3)(Analyse/IOCQ)]*

(3 + 3) + (4 + 2) = 12

5. (a) Discuss the concept of "gas" in the context of Ethereum smart contracts. Explain how gas fees are calculated and why they are necessary. Analyse the impact of gas fees on the accessibility and usability of decentralized applications (dApps). *[(CO3)(Understand/LOCQ)]*

   (b) Compare and contrast state variables and functions within a smart contract. Explain how they contribute to the functionality and persistence of data. Provide examples of different types of state variables and functions and their use cases. *[(CO5)(Analyse/IOCQ)]*

6 + 6 = 12

Group - D

6. (a) Define a structure named student to store information of a student (roll, name, marksInPhysics, marksInChemistry, marksInMathematics). Write a solidity program, which will take as input the roll, name and numbers obtained by several students in different subjects. The program will calculate the total marks obtained by each student and display the list of students in descending order according to the total marks. *[(CO4,CO5,CO6)(Apply/HOCQ)]*

   (b) Why we use virtual and override keyword? Give an example and explain it. *[(CO5)(Remember/LOCQ)]*

8 + 4 = 12

7. (a) Write a solidity program to find the largest element found present in a matrix using user defined function. *[(CO4,CO5,CO6)(Apply/IOCQ)]*

   (b) Write a solidity program to find the sum of diagonal elements of a matrix using user defined function. *[(CO4,CO5,CO6)(Apply/IOCQ)]*

5 + 7 = 12

Group - E

8. (a) Explain the fundamental architecture of a decentralized application (DApp) and how it differs from a traditional web application. *[(CO2)(Understand/IOCQ)]*

   (b) Describe the process of connecting a frontend application to the blockchain and interacting with a smart contract. *[(CO2)(Understand/IOCQ)]*

6 + 6 = 12

9. (a) How to code a basic Decentralized Application (DApp)? *[(CO5)(Apply/IOCQ)]*

(b) How to create a voting contract and DApp? *[(CO5)(Apply/IOCQ)]*

6 + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	35.42	56.25	8.33